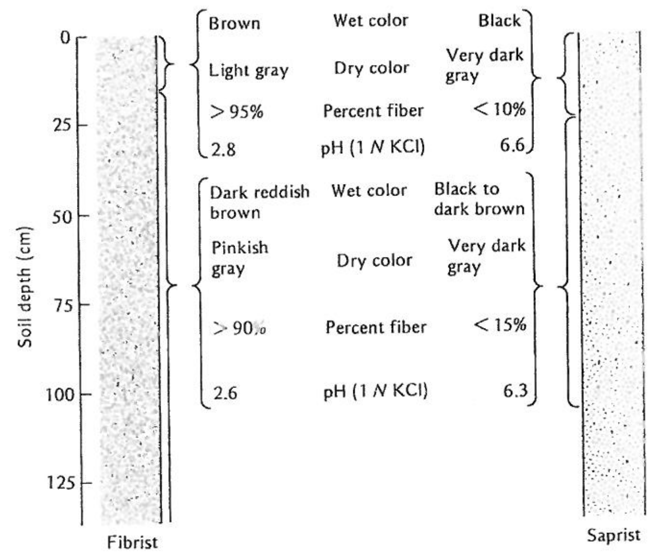

FIGURE 10.16
Two organic soil profiles showing distinguishing characteristics of each. (a) An uncultivated soil of the Fibrist suborder with a high percentage of undecomposed fiber and high acidity. (b) In contrast, a cultivated soil of the Saprist suborder with only 10–20% undecomposed fibers and reasonably low acidity. Both soils are found in Minnesota. [Modified from Farnham and Finney (1966)]

tinguishing among these suborders, the Fibrists having the least decayed materials, the Saprists the most, and the Hemists being intermediate in this regard.

Drawings of organic soil profiles representative of the Saprist and Fibrist suborders are shown in Figure 10.16. The Fibrist soil has a high percentage of undecomposed fibrous materials and is very acid. The cultivated Saprist soil has a nearly neutral pH, low undecomposed fiber percentage, and is darker in color.

10.20
Physical Characteristics of Field Peat Soils

COLOR

A typical cultivated Histosol is dark brown to intensely black in color even though it may have developed from materials that were gray, brown, or reddish brown. The changes that the organic matter undergoes as it decomposes seem to be similar to those occurring in the organic residues of mineral soils as they are broken down.

BULK DENSITY

Histosols are light in weight when dry. The bulk density of a peat surface soil is only 0.20–0.30 Mg/m^3 compared to 1.25–1.45 Mg/m^3 for mineral surface soils. Thus, a hectare–furrow slice of a dry Histosol weighs only 15–20% as much as a dry mineral soil.

WATER-HOLDING CAPACITY

A third important property of a Histosol is its high water-holding capacity on a mass basis. While a dry mineral soil will adsorb and hold from one fifth to two fifths its weight of water, a well-humified organic soil will retain two to four times its dry weight of moisture. Undecayed or only slightly decomposed moss or sedge peat has an even greater water-holding capacity, being able to hold water to the extent of 12, 15, or even 20 times its dry weight. This explains in part the value of moss and sedge peat in greenhouse and nursery operations.

Unfortunately, Histosols in the field do not greatly surpass mineral soils in their capacity to supply plants with water for two reasons. First, their amounts of *unavailable* water are much higher proportionately than those of mineral soils. Second, the light weight of organic soils means that a given *volume* of organic soil may not hold much more water than the same volume of a mineral soil. For these two reasons a given volume of peat soil at optimum moisture will supply only slightly more water to plants than a comparable mineral soil.

Structure

A fourth outstanding characteristic of a typical woody or fibrous organic soil is its almost invariably loose physical condition. While humified organic matter is largely colloidal and possesses high adsorptive powers, its cohesion and plasticity are rather low. Most Histosols are, therefore, porous, open, and easy to cultivate. These characteristics make this type of soil especially desirable for vegetable production. However, during dry periods light, loose peat, whose granular structure has been destroyed by cultivation, may erode badly in a high wind and result in extensive crop damage. Peat also may ignite when dry. Such a fire often is difficult to extinguish and may continue for several years.

10.21 Chemical Characteristics of Histosols

The colloidal nature of organic soil material already has been emphasized (see Section 7.2). The same graphic formula employed for mineral soils can be used to represent the colloidal complex of organic soils.

$$\begin{matrix} Ca^{2+} \\ H^{+} \\ Mg^{2+} \end{matrix} \boxed{\text{Micelle}}$$

The micelle is humus, and the base-forming cations are adsorbed in the same order of magnitude as in mineral soils: $Ca^{2+} > Mg^{2+} > K^{+}$ or Na^{+} (see Section 7.3).

Cation Exchange

On a mass basis, maximum cation exchange capacities of organic colloids are two to ten times higher than those for the inorganic colloids. But on a volume basis, as shown in Table 10.3, most of this difference disappears. In fact, a cubic meter of vermiculite has about twice the cation exchange capacity of an equal volume of organic colloid. Under acid conditions, this difference is even more pronounced since the negative charges on the organic colloids are pH dependent in contrast to the permanent charges on 2:1-type clay colloids. However, fine-grained micas, kaolinite, and hydrous oxide clays have lower capacities than the humus, even on a volume basis.